AMENDMENTS TO THE SPECIFICATION

Please amend the paragraph beginning at page 13, line 22, as follows:

An exemplary power supply [[380]] (not shown) for the process provides up to 10 volts at an average current of 30 amps and a peak current of 60 amps. The power supply requirements will change depending on the size of the area to be electroplated on the workpiece. The current density may be 100-300 mA/cm^2. A particularly useful current density is 150-220 mA/cm^2. The waveform may be a pulse with a 10-50% duty cycle at 50-1000 Hz, as well as a DC. A particularly useful waveform is a DC and a pulse with a 50% duty cycle at 100 Hz. The power supply and other components of the tool are controlled by a controller [[400]] (not shown).

Please amend the paragraph beginning at page 13, line 30, through page 14, line 2, as follows:

An exemplary mode of electroplating is to rotate the workpiece in a plating chamber at a speed of 20-200 revolutions per minute with the plating bath flowing against the workpiece at a flow rate of 1-10 gallons per minute. For a 150~200 mm-diameter wafer, the most preferred rotation speed is 20-60 revolutions per minute. For a 150~200-mm diameter wafer, the most preferred flow rate is 4-6 gallons per minute.

Please amend the paragraph beginning at page 14, line 25, as follows:

In FIGURE 4, copper layer 34 has been electroplated on top of ~~conductive layer~~ second thin metal film 30 within opening 33 by employing the high rate electroplating process described above. This copper layer 34 is frequently referred to as a stud. Copper layer 34 is then covered by solder layer 36, which is also deposited by electroplating.

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS PLLC
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

AMENDMENTS TO THE CLAIMS

1-19. (Canceled)

20. (Currently amended) A process for electroplating copper on a microelectronic workpiece in a through-mask plating application at a rate of at least 2 μm/min, said process comprising:

(a) providing a plating bath comprising:

(1) ~~50-85 g/L of~~ Cu^{2+};

(2) ~~50-100 g/L of~~ H_2SO_4;

(3) ~~30-150 ppm of~~ Cl^-;

(4) a brightener;

(5) a wetting agent; and

(6) water;

(b) providing a microelectronic workpiece having one or more through-mask openings with a conductive layer at the bottom of said opening;

(c) contacting said conductive layer with said plating bath;

(d) providing electroplating power between said conductive layer and an anode disposed in electrical contact with said bath; and

(e) depositing copper onto said conductive layer at a rate of at least 2 μm/min.

21. (Original) The process of Claim 20, wherein the current density of said electroplating power is 100-300 mA/cm^2.

22. (Original) The process of Claim 21, wherein the current density of said electroplating power is 150-220 mA/cm^2.

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS PLLC
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

23. (Original) The process of Claim 20, wherein the waveform of said electroplating power is a DC and a pulse with a 10-50% duty cycle at 50-1000 Hz.

24. (Original) The process of Claim 20, wherein said workpiece is rotated at a speed of 20-200 revolutions per minute and wherein said bath flows against said workpiece at a flow rate of 1-10 gallons per minute.

25. (Original) The process of Claim 20, wherein said bath has a temperature of 25-35°C.

26. (Original) The process of Claim 20, wherein the depositing step further comprising depositing copper to form a deposited feature having a smooth surface morphology.

27. (Original) The process of Claim 20, wherein the depositing step further comprising depositing copper to form a deposited feature that has a substantially flat surface.

28. (Original) The process of Claim 20, wherein the depositing step further comprising depositing copper to form a deposited feature that has a thickness variation of less than 10%.

29. (Currently amended) A process for electroplating copper on a microelectronic workpiece in a through-mask plating application at a rate of at least 2 μm/min, said process comprising:

(a) providing a plating bath comprising:

(1) ~~50-85 g/L of~~ Cu^{2+};

(2) ~~50-100 g/L of~~ H_2SO_4;

(3) ~~30-150 ppm of~~ Cl^-;

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS PLLC
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206 682 8100

(4) a brightener;

(5) a wetting agent;

(6) a leveler; and

(7) water;

(b) providing a microelectronic workpiece having one or more through-mask openings with a conductive layer at the bottom of said opening;

(c) contacting said conductive layer with said plating bath;

(d) providing electroplating power between said conductive layer and an anode disposed in electrical contact with said bath; and

(e) depositing copper onto said conductive layer at a rate of at least 2 μm/min.

30. (Original) The process of Claim 29 wherein the current density of said electroplating power is 100-300 mA/cm^2.

31. (Original) The process of Claim 30 wherein the current density of said electroplating power is 150-220 mA/cm^2.

32. (Original) The process of Claim 29 wherein the waveform of said electroplating power is a DC and a pulse with a 10-50% duty cycle at 50-1000 Hz.

33. (Original) The process of Claim 29 wherein said workpiece is rotated at a speed of 20-200 revolutions per minute and wherein said bath flows against said workpiece at a flow rate of 1-10 gallons per minute.

34. (Original) The process of Claim 29 wherein said bath has a temperature of 25-35°C.

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS PLLC
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

35. (Original) The process of Claim 30, wherein the depositing step further comprising depositing copper to form a deposited feature having a smooth surface morphology.

36. (Original) The process of Claim 30, wherein the depositing step further comprising depositing copper to form a deposited feature that has a substantially flat surface.

37. (Original) The process of Claim 30, wherein the depositing step further comprising depositing copper to form a deposited feature that has a thickness variation of less than 10%.

38-43. (Canceled)

44. (New) A process for electroplating copper on a microelectronic workpiece in a through-mask plating application at a rate in the range of about 4 μm/min to about 6 μm/min, said process comprising:

(a) providing a plating bath comprising:

(1) Cu^{2+};

(2) H_2SO_4;

(3) Cl^-;

(4) a brightener;

(5) a wetting agent; and

(6) water;

(b) providing a microelectronic workpiece having one or more through-mask openings with a conductive layer at the bottom of said opening;

(c) contacting said conductive layer with said plating bath;

(d) providing electroplating power between said conductive layer and an anode disposed in electrical contact with said bath; and

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS PLLC
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100

(e) depositing copper onto said conductive layer at a rate in the range of about 4 μm/min to about 6 μm/min.

45. (New) A process for electroplating copper on a microelectronic workpiece in a through-mask plating application at a rate in the range of about 4 μm/min to about 6 μm/min, said process comprising:

(a) providing a plating bath comprising:

(1) Cu^{2+};

(2) H_2SO_4;

(3) Cl^-;

(4) a brightener;

(5) a wetting agent;

(6) a leveler; and

(7) water;

(b) providing a microelectronic workpiece having one or more through-mask openings with a conductive layer at the bottom of said opening;

(c) contacting said conductive layer with said plating bath;

(d) providing electroplating power between said conductive layer and an anode disposed in electrical contact with said bath; and

(e) depositing copper onto said conductive layer at a rate in the range of about 4 μm/min to about 6 μm/min.

LAW OFFICES OF
CHRISTENSEN O'CONNOR JOHNSON KINDNESS PLLC
1420 Fifth Avenue
Suite 2800
Seattle, Washington 98101
206.682.8100